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The Relationship of Reaction Time to Success in High School Wrestling

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THE RELATIONSHIP OF REACTION TIME TO SUCCESS IN HIGH SCHOOL WRESTLING

(TITLE)

BY

Herbert A. Spyke

THESIS

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CHAPTER I

INTRODUCTION

Background for the Study

The matter of determining wrestling potential in beginners is of utmost importance to the wrestling coach today. This becomes most apparent in situations in which large numbers of boys are interested in the program and facilities are limited. Wrestling is a sport in which almost all of the fundamentals must be taught when the boys first join the squad, whereas in such sports as basketball, baseball, and football most American boys have had some experience in the sport by the time they reach their school coach. Thus, because of this fact, it is a wise wrestling coach who bases his selections for places on the squad as much upon the potential of those boys involved as upon the actual performance of the boys during these early stages of skill development. In order to successfully determine wrestling potential, however, the coach must know what specific traits or qualities to look for in an individual, which might indicate this potential.

The matter of determining what specific qualities are related to wrestling ability thus becomes a significant problem for the scholastic coach who, out of necessity, must select squad members from a large group of candidates.

Unfortunately, there is no general agreement as to which qualities are most closely correlated with wrestling ability. Various physical elements such as strength, flexibility, balance, body build, speed-of-movement and reaction time are commonly thought to bear some relationship to wrestling ability.

Reaction time is included in this group because, in wrestling, as in most sports, the matter of reacting quickly--or at least more quickly than one's opponent--seems to be a factor which contributes to success. The main point of controversy, however, is the extent of this significance. There is a need to investigate the reaction times of wrestlers in order to ascertain whether reaction time alone is significant enough to be a factor in the actual achievement of success in wrestling or whether, because of the various other qualities which contribute to success in wrestling, reaction time becomes relatively unimportant.

A knowledge of the significance or lack of significance of reaction time in the achievement of success in wrestling could greatly aid the coach in trying to determine the wrestling potentials of his prospective team members.

Statement of the Problem

The purpose of this study was to determine the relationship of finger reaction time to success in high school wrestling.

Limitations and Assumptions

There were two outstanding limitations to this study. First, the reaction time test was limited to 102 high school wrestlers from various schools participating in the 1968 Decatur MacArthur District and Champaign Central Sectional Tournaments in the State of Illinois and second, the majority of the subjects were tested within a few hours prior to participating in the District or Sectional Tournaments. This latter fact might have been responsible for an unusual amount of anxiety among the subjects which may have affected their performance on the test.

Also, in considering the results of this study, the following assumptions must be made: (1) The measuring device used in this study, the Dekan Athletic Performance Analyzer, gave valid indications of finger reaction time and (2) the won-lost records obtained from the subjects and their respective coaches were correct and were meaningful measures of success.

Definition of Terms

For the purposes of this study, the following terms should be defined:

Wrestler--Any member of a high school wrestling team who participated in five or more varsity wrestling matches during the 1967-68 wrestling season.

Finger reaction time--The lapse of time between the application of a stimulus and the beginning of a movement of the finger.

Won-lost record--The number of wrestling matches won, lost, and tied by a wrestler during the 1967-68 wrestling season prior to the District Tournament in which he participated.

Year of experience--Any year in which a wrestler was a member of a school-sponsored wrestling squad.

Mean reaction time--The representative reaction time test score which was obtained for each subject by discarding the two fastest and the two slowest of the ten reaction time trials and then dividing the sum of the results of the remaining six trials by six.

Success Score--An index of wrestling success which was computed for each subject by assigning two points for each wrestling match won, one point for each match tied and no points for each match lost and then dividing the total points earned by the number of matches wrestled.

CHAPTER II

REVIEW OF LITERATURE

Studies concerned with the nature of reaction time itself, the relationship of reaction time to success in various sports, the various physical factors related to successful wrestling and the reaction times and movement times of wrestlers were considered relevant to the present investigation.

Nature of Reaction Time

The ability to react quickly has long been recognized as an important factor in athletic competition, and as a result, many investigations have been made by physical educators and other researchers to learn more about this quality.

Tweit, Gollnick, and Hearn[1] undertook a study to determine the effects of a training program upon total body reaction time. Under the conditions of their study, statistically significant improvements were displayed in reaction time following a training program. Thus, it was concluded that reaction time can be improved by training.

A study conducted by Hoogendoorn[2] concluded that reaction time was not influenced significantly by either body cooling or

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[1] A. H. Tweit, P. D. Gollnick, and G. R. Hearn, "Effect of a Training Program on Total Body Reaction Time of Individuals of Low Fitness," Research Quarterly, XXXIV (December, 1963), pp. 508-13.

[2] Russell H. Hoogendoorn, "The Effects of Cooling and Various Intensities of Preliminary Exercise on Reaction Time," (unpublished Master's thesis, University of Toledo, 1963).

preliminary exercise, even of an exhaustive nature. Phillips[1] also concluded that reaction time is not influenced by heavy warm-up exercises that do improve speed of movement. He also found that reaction time is not influenced by interpolated activities (related or unrelated activities) that are continued to a point of considerable fatigue and that reaction time and speed of movement are substantially uncorrelated.

Lotter[2] undertook a study to try to determine the relationship between the reaction time and movement time of the legs and the reaction time and movement time of the arms. From the results, he concluded that leg movements are slower and have a longer reaction time than arm movements.

The question of whether or not differences exist in reaction time between Negro and white athletes was investigated by Harsch.[3] He used 27 Negro and 43 white athletes on freshman and varsity athletic teams at the State University of Iowa during the 1958-59 school year, as subjects. Thirty white non-athletes were also used in the study. Under the conditions of this study, it was concluded that Negro athletes do not react or respond more quickly than white athletes.

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[1]William H. Phillips, "Influence of Fatiguing Warm-up Exercises on Speed of Movement and Reaction Latency," Research Quarterly, XXXIV (October, 1963), pp. 370-78.

[2]William S. Lotter, "Interrelationships Among Reaction Times and Speeds of Movement in Different Limbs," Research Quarterly, XXXI (May, 1960), pp. 147-55.

[3]Larry A. Harsch, "A Comparative Study of the Reaction Times and Response Times of Negro and White Athletes," (unpublished Master's thesis, University of Iowa, 1959).

Nash, et al[1] conducted an experiment to determine the effect of anxiety upon reaction time. In order to measure the effect of induced anxiety upon the thirty-six female subjects, an electric shock was given to the subjects five times during ten reaction time trials and the results were compared with the results of ten trials without the electric shock. The results showed the mean reaction time of the anxiety-induced subjects to be significantly slower than that of the non-induced anxiety subjects. However, the investigators believed that the slowness may have been due to the distraction element involved which was brought about by the inability to concentrate and prepare for the stimulus because of the fear of electric shock.

Athletes vs. Nonathletes

Many studies have been made to compare the reaction times of athletes with those of nonathletes. In all of the studies reviewed by the writer, athletes as a group were found to have

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[1] E. L. Nash, J. G. Phelan, G. Demas and T. L. Bittner, "Effects of Manifest and Induced Anxiety and Experimenter Variability on Simple Reaction Time," Perceptual and Motor Skills, XXII (April, 1966), pp. 483-87.

significantly faster reaction times than nonathletes as a group.[1,2,3,4,5] These findings seem to support the hypothesis that fast reaction time is closely related to athletic participation.

Reaction Time and Success in Specific Sports

Several investigators have attempted to determine the relationship of reaction time to success in specific sports.

Steitz[6] attempted to determine the relationship of reaction time and various other selected factors to success in various specific sports. The subjects were 196 Springfield College male students, each of whom participated in one of nine freshman sports. They were tested for reaction time, performance time, speed, Sargent Jump, and physical fitness. The coach

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[1] Barbara Knapp, "Simple Reaction Times of Selected Top-class Sportsmen and Research Students," Research Quarterly, XXXII (October, 1961), pp. 409-10.

[2] Lois Younger, "A Comparison of Reaction and Movement Times of Women Athletes and Nonathletes," Research Quarterly, XXX (October, 1959), pp. 349-55.

[3] William J. Considine, "Reflex and Reaction Times Within and Between Athletes and Nonathletes," (unpublished Master's thesis, Illinois State University, 1966).

[4] James J. Wilkinson, "A Study of Reaction Time Measures to a Kinesthetic and Visual Stimulus for Selected Groups of Athletes and Non-athletes," (unpublished Doctoral dissertation, Indiana University, 1958).

[5] Larry A. Harsch, loc. cit.

[6] Edward S. Steitz, "The Relationship of Reaction Time, Speed, Sargent Jump, Physical Fitness, and Other Variables to Success in Specific Sports," (unpublished Doctoral dissertation, Springfield College, 1963).

in each sport ranked each squad member in terms of overall value as a performer, and the ratings were converted to numerical values as a criterion of success in sports. Multiple correlations were computed for each of the activities and *t* ratios were determined for possible differences between the teams. The reaction time of the left foot moving left and the right foot moving left along with the Sargent Jump were the variables appearing most frequently in the multiple correlations. Thus, this study has shown that reaction time does appear to be an important factor in the achievement of success in specific sports.

Knapp[1] tested the reaction times of twenty participants in racket games (tennis and badminton) and twenty non-participants and found that the reaction times of the racket game participants were significantly faster than the reaction times of the non-participants. Thus, she concluded that reaction time was related to success in racket games.

An investigation comparing hand and foot reaction times of basketball players with those of nonathletes was undertaken by Sigerseth and York.[2] The subjects used in the study were 144 high school males in the State of Oregon, 72 of which had earned varsity letters in basketball and 72 of which had never participated in any form of interscholastic athletics. The

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[1] Knapp, loc. cit.

[2] Peter O. Sigerseth and Norman N. York, "Comparison of Certain Reaction Times of Basketball Players and Non-athletes," The Physical Educator, XI (March, 1954), pp. 51-3.

basketball letter winners were found to be significantly superior to the nonathletes in both hand and foot reaction time. The varsity letter was considered a mark of success in high school basketball.

Thompson[1] attempted to determine the effect of reaction time upon volleyball playing ability. Her subjects were twenty-four college women, twelve of whom were designated as skilled as a result of their participation on extramural volleyball teams at the University of Illinois, and twelve of whom were designated as unskilled due to their enrollment in beginning volleyball classes in the women's physical education department in the same institution. The difference in skill of the two groups was verified by means of a wall-volley test and by judges' ratings. The subjects were tested for various qualities including simple finger reaction time and total body reaction time with a Dekan Athletic Performance Analyzer. For the reaction time tests, twenty trials were given to each subject and a "median score" was obtained for each subject. A *t* ratio was then computed comparing the differences between the skilled and unskilled groups. The *t* ratio for the median simple reaction times of the two groups was not significant while the *t* ratio for the median total body reaction times was found to be significant at the .01 level of confidence. It was then concluded that the skilled players were not superior to the

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1. Carol A. Thompson, "A Study of Various Reaction Times and Movement Times as Factors of Volleyball Playing Ability," (unpublished Master's thesis, University of Illinois, 1962).

unskilled players in simple reaction time but that total body reaction time is a factor in volleyball playing ability.

Various Physical Factors and Wrestling Ability

Many studies have been made to try to determine the relationship of various physical factors to success in competitive wrestling.

Bremner[1] conducted a study investigating several factors and their relationship to success in wrestling while Meyer[2], Bush[3], and Rasch and Brant[4] conducted studies concerning the body builds of wrestlers. Other factors investigated were strength by Lynch[5], Tomaras[6], Cutlip[7], Bryan[8], Rasch, et al[9]

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[1] J. Barron Bremner, "Measurement of Potential Wrestling Ability," (unpublished Master's thesis, University of Iowa, 1964).

[2] Herbert H. Meyer, "Anthropometry of Athletes," (unpublished Master's thesis, University of Michigan, 1945).

[3] Russell L. Bush, "A Study of the Relationships Between Anthropometric Measurements and Wrestling Maneuvers," (unpublished Master's thesis, Purdue University, 1950).

[4] Philip J. Rasch and John W. A. Brant, "Measurements of Pulmonary Function in United States Olympic Freestyle Wrestlers," Research Quarterly, XXVIII (March, 1957), pp. 279-87.

[5] John J. Lynch, "A Survey Study of the Problems of Weight-Reduction in S.S.C.I.F. Wrestling," (unpublished Master's thesis, San Diego State College, 1960).

[6] William A. Tomaras, "The Effect of Wrestling Upon Physical Fitness," (unpublished Master's thesis, University of Illinois, 1948).

[7] John L. Cutlip, "The Effect of Grip Strength In Relation to Success in High School Wrestling," (unpublished Master's thesis, Eastern Illinois University, 1967).

[8] Howard M. Bryan, "Effects of Weight Reduction on Strength and on Muscular Endurance," (unpublished Master's thesis, State University of Iowa, 1953).

[9] Philip J. Rasch, William P. Pierson, Eugene R. O'Connell, and M. B. Hunt, "Effect of Training for Amateur Wrestling on Total Proportional Strength Scores," Research Quarterly, XXXII (March, 1961), pp. 201-7.

and Kroll[1], flexibility by Meister[2] and Leighton[3], and balance by Rasch and Kroll[4], and Mumby[5].

Movement and Reaction Times and Wrestling Ability

Several studies have also been reviewed by the writer which investigated the qualities of movement time and reaction time as they relate to wrestlers. These studies will be discussed individually.

A study investigating the relation of movement time to success in specific sports, including wrestling, was conducted by Keller.[6] The subjects were 755 high school and college students who were first categorized into two groups--359 athletes and 277 nonathletes. The group of athletes was assessed for athletic success by two methods of rating, one of which was based upon performance and the other upon estimates by coaches

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[1]Walter Kroll, "Selected Factors Associated with Wrestling Success," Research Quarterly, XXIX (March, 1958), pp. 396-406.

[2]W. Meister and G. Nowalzig, "Konstitutions - und Kreislaufuntersuchungen an Berufsringein," Biology Abstracts, XIV (Number 4663, 1940), p. 438.

[3]Jack R. Leighton, "Flexibility Characteristics of Three Specialized Skill Groups of Champion Athletes," Archives of Physical Medicine, XXXVIII (1957), pp. 580-83.

[4]Philip J. Rasch and Walter Kroll, What Research Tells the Coach About Wrestling, (Washington, D.C.: American Association for Health, Physical Education and Recreation, 1964), p. 15.

[5]H. Hugh Mumby, "Kinesthetic Acuity and Balance as Related to Wrestling Ability," Research Quarterly, XXIV (March, 1953), pp. 327-41.

[6]Louis F. Keller, "The Relation of Quickness of Movement to Success in Athletics," Research Quarterly, XIII (March, 1942), pp. 146-55.

and physical education teachers. The former was obtained from questionnaires and institution records, while the latter was procurred directly from coaches and teachers who were well-acquainted with the subjects. In each case the individual was given a rating of A, B, C, D or E. The scores (quickness scores) for subjects who participated in baseball, football, gymnastics, swimming, track and wrestling were compared to determine the significance of the differences or relationships occurring in the quickness scores of athletes in different sports. It was found that there was a significant positive correlation between quickness and success and also concluded that a person with relatively slow body movement time had a better chance of attaining success in the more individual activities such as gymnastics, swimming, and wrestling than in baseball, basketball, and football. Also, only the swimmers were slower than the wrestlers under the conditions of Keller's test.

Another study investigating the same quality as the preceeding investigation was conducted by Kroll[1], although he used the term response time and defined it as "the time between the presentation of a stimulus and the completion of the entire maneuver." He tested for reaction time as well as for movement time in order to determine response time. The main purpose of the study was to determine the relationships of total response times for two wrestling takedown maneuvers, a strength test,

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[1] Kroll, loc. cit.

and initial takedown ability to success in high school wrestling. One hundred Illinois high school varsity wrestlers from eight teams which had scored points in the State Tournament the previous year were used as subjects. The wrestlers were divided into successful and unsuccessful groups on the criterion of having won in the state sectional tournaments. There were no significant differences between successful and unsuccessful wrestlers in total response times, reaction times, or in movement times.

Rasch and Pierson[1] tested twelve karateka and twenty-four A.A.U. wrestlers for finger reaction time and movement time and compared the two groups. No significant differences in reaction times were found between the two groups although the karateka were found to be significantly faster in movement time when the times were corrected for age.

In an earlier study, Rasch, et al[2] measured the reaction times and movement times of 40 nonwrestlers, 11 collegiate wrestlers, 32 A.A.U. wrestlers and 11 members of the Japanese Amateur Wrestling Association team and found no significant differences in reaction times or movement times among any of the groups.

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[1] Philip J. Rasch and W. R. Pierson, "Reaction and Movement Times of Experienced Karateka," Research Quarterly, XXXIV (May, 1963), pp. 242-3.

[2] Philip J. Rasch, William R. Pierson, Eugene R. O'Connell, and M. Briggs Hunt, "Response Time of Amateur Wrestlers," Research Quarterly, XXXII (October, 1961), pp. 416-18.

Smith[1] compared the reaction times and movement times of college wrestlers and physical education students in response to visual, tactile, and auditory stimuli and also found no significant differences between the two groups.

Wilkinson[2] obtained results which were somewhat contradictory to the studies mentioned above. His study compared the reaction times of wrestlers, baseball players, football players, basketball players, and nonathletes. It was found that wrestlers responded significantly faster to the dropping of the arm from the horizontal position upon release of a supporting apparatus and to a visual signal than did baseball players, football players, basketball players, and nonathletes.

Despite the many related studies which have been cited above, only the study by Kroll[3] dealt directly with the problem of determining the relationship of reaction time to success among wrestlers.

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[1] Glen R. Smith, "Comparison and Relationship Between Reaction Time, Performance Time, and Balance Among Wrestlers and Physical Education Students in College," (unpublished Master's thesis, South Dakota State College, 1960).

[2] James J. Wilkinson, "A Study of the Reaction-Time Measures to a Kinesthetic and a Visual Stimulus for Selected Groups of Athletes and Nonathletes," (unpublished Doctoral dissertation, Indiana University, 1958).

[3] Kroll, loc. cit.

CHAPTER III

PROCEDURE

The description of the subjects, the instruments used for measurement, the methods of measurement, and all other techniques used to obtain data will be included in this chapter.

Subjects

The subjects used in this study were 102 high school wrestlers from various high schools participating in the 1968 District and Sectional Wrestling Tournaments held at Decatur MacArthur (N = 64) and Champaign Central (N = 38) High Schools respectively. The testing was done at these two tournament sites within a period of four hours previous to the beginning of the first night's competition. The Sectional participants were wrestlers who had placed first or second in their district meets. All subjects used in the study had participated in five or more varsity wrestling matches during the 1967-68 season prior to the District Tournaments in which they participated, were selected without consideration for weight, strength, body build, flexibility, or race, and participated in the study voluntarily and with the consent of their coaches.

Measurements

The finger reaction times of the subjects were measured by means of a Dekan Athletic Performance Analyzer, Model 621. The apparatus consisted of a manual delay-start button, a delay adjust dial, a signal lamp, a chronoscope which timed to the nearest .01 of a second, and a control cord with a stop-button switch (see Fig. 1).

Testing at Decatur MacArthur High School took place in the privacy of one of the coaches' offices. At Champaign Central High School, the testing was done behind a curtain on the stage of the gymnasium.

Each subject was seated, asked to hold the stop-button switch in his dominant hand, and to press the button with the index finger of the same hand as soon as he saw the signal lamp flash. The investigator then pressed the delay-start button which started the mechanism. Within five seconds, the signal lamp flashed and started the chronoscope and, in turn, the pressing of the stop button by the subject stopped the chronoscope.

Each subject was given one practice trial followed by ten trials in succession, the results of which were recorded. The delay adjust dial was rotated after each trial, thus greatly reducing the possibility of the subjects becoming accustomed to a set time lapse and reacting before the light actually flashed, sometimes called guessing. The investigator gave a preparatory command of "ready" before pressing the manual delay-start button for each trial.

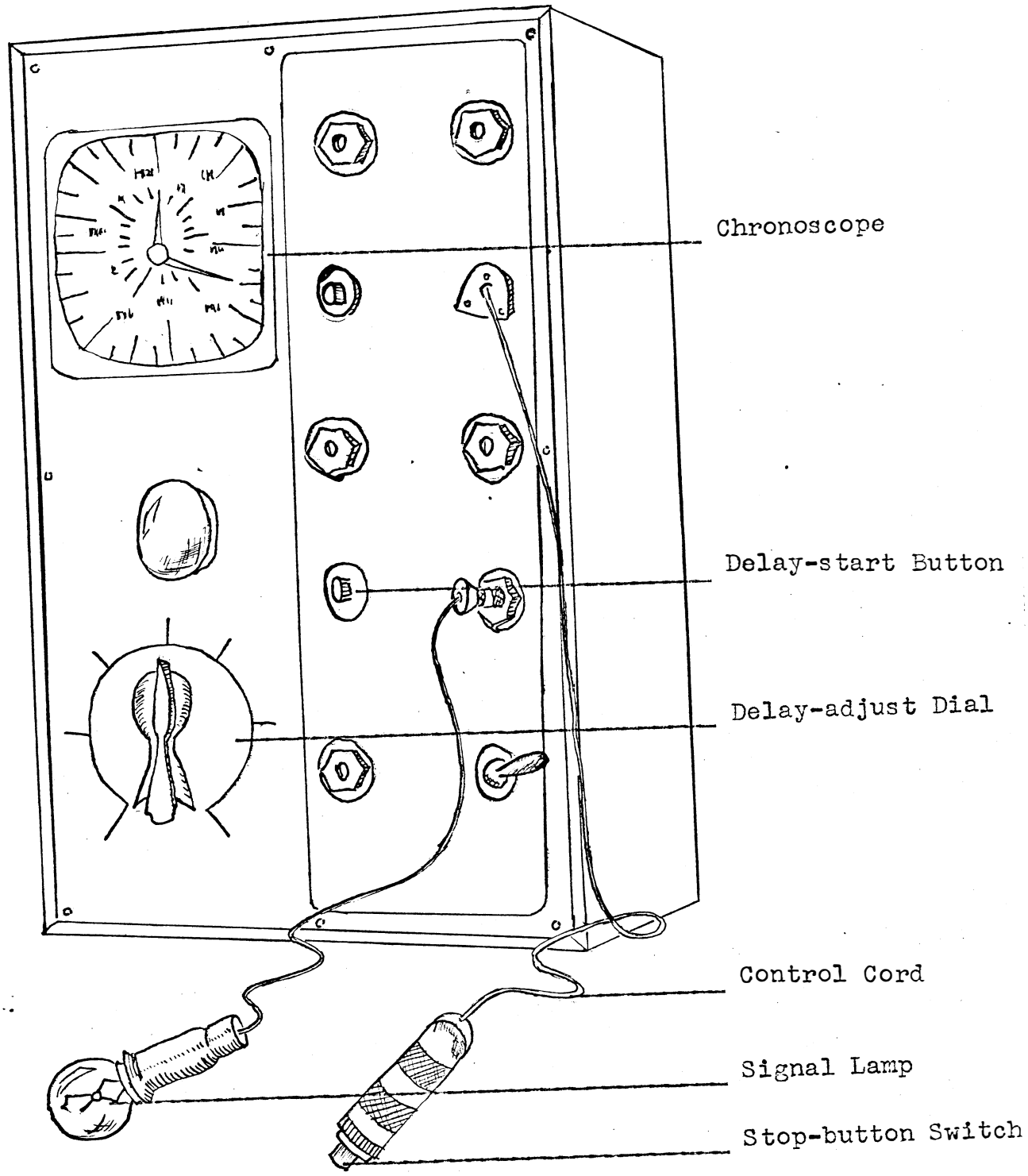

Figure 1--Dekan Athletic Performance Analyzer

A prepared data sheet, a sample of which can be found in Appendix A, was used to record the results of the ten trials and all other data obtained.

The two fastest and the two slowest readings obtained were discarded and the remaining six readings were averaged to obtain a mean reaction time for each subject. The mean reaction time was computed to the nearest .001 of a second.

Related Personal Information

Prior to being tested, each wrestler was asked his name, school, number of years of wrestling experience, and won-lost record for that season prior to the District Tournament. The coach of each wrestler was then asked to verify the subject's replies and make any corrections that were necessary. The replies were recorded on the previously-mentioned data sheet.

Several weeks after the testing took place, letters were sent to the coaches who were either unavailable or unable, at the time of the testing, to verify their wrestlers' replies to the question concerning won-lost records. The letters, an example of which can be found in Appendix B, requested the correct won-lost records for the wrestlers tested. Replies were received to all of these letters and the accumulation of data was thus completed.

CHAPTER IV

ANALYSIS OF DATA

The primary purpose of this investigation was to determine the relationship between speed of finger reactions and success, as determined by won-lost records, in high school wrestling.

Though not of primary importance in this study, a subproblem was undertaken involving the comparison of the mean reaction time of all subjects who participated in the Decatur MacArthur District Tournament and the mean reaction time of all subjects who participated in the Champaign Central Sectional Tournament. Since all varsity wrestlers are eligible to participate in a district tournament, but only those who are successful in the district are eligible for the sectional tournament, the group of subjects tested at the Champaign Central Sectional Tournament were considered to be more successful as a group than the subjects tested at the Decatur MacArthur District Tournament.

Reliability of Reaction Time Test

The reliability of the reaction time test employed by the investigator was determined by performing a rank-order correlation between the odd and even trials of ten subjects selected at random. Only the six trials which were used to

compute the mean reaction time for each subject were considered. The rank-order correlation coefficient or rho was +.98 which indicated a high degree of reliability.

Success Score

The first procedure that was followed in the treatment of the data was the conversion of the won-lost record to a success score by awarding two points for each match won, one point for each match tied and no points for each match lost and by dividing the total points earned by the total number of matches wrestled. The highest success score attainable was 2.0, while the lowest was 0.

Correlation Technique

Each subject was categorized according to the number of years of wrestling experience that he had had. Four categories were found to exist: one year of experience (N = 15), two years of experience (N = 25), three years of experience (N = 29), and four years of experience (N = 33).

An IBM card for each subject was punched with each individual's success score, mean reaction time and years of wrestling experience. A correlation program developed by DiPietro, et al[1] was then employed with the IBM #1620 Computer to determine the correlation coefficients for the two variables at each of the four experience levels and for the total number of subjects combined.

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[1] A. J. DiPietro, Roy Meyerholtz, and Richard LeDuc, "Correlation Analysis for an Unfixed Number of Variables (Cards)." (Charleston: Eastern Illinois University, July 15, 1964).

The correlation coefficients obtained were then checked against a table published by Arkin and Colton[1] to determine their statistical significance.

t ratio Computation

The difference in the mean reaction times of the 64 district participants and the 38 sectional participants was computed and in order to determine whether this difference was significant a Student's t ratio was calculated according to the formula presented by Hoel.[2]

Findings

Relationships of Reaction Times to Wrestling Success Scores

One-year Experience Group (N = 15).--The mean reaction time for the group of subjects who were in the one-year experience category was .15 of a second and the standard deviation was .020 while the mean success score was .78 with a standard deviation of .457. The correlation coefficient of the two variables was found to be +.549 which was significant at the .05 level of confidence.

Two-year Experience Group (N = 25).--The mean reaction time for the two-year experience group was .14 of a second and the standard deviation was .018 while the mean success

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[1] Herbert Arkin and Raymond R. Colton, Tables for Statisticians (New York: Barnes and Noble, 1950), p. 140.

[2] Paul G. Hoel, Introduction to Mathematical Statistics (New York: John Wiley and Sons, Inc., 1954), p. 227.

score was 1.16 with a standard deviation of .368. The correlation coefficient of the two variables was found to be +.052 which was not statistically significant.

Three-year Experience Group (N = 29).--For the three-year experience group the mean of the reaction times was .14 of a second and the standard deviation was .015 while the mean of the success scores was 1.39 with a standard deviation of .421. The correlation coefficient for the two variables was +.747 which was found to be significant beyond the .01 level of confidence.

Four-year Experience Group (N = 33).--The mean reaction time of the subjects at the four-year experience level was .14 of a second and the standard deviation was .015 while the mean of the success scores was 1.52 with a .407 standard deviation. The correlation coefficient for the two variables was found to be +.181 which was not statistically significant.

Composite (N = 102).---The mean of the reaction times for all subjects tested, disregarding the experience variable, was .14 of a second with a standard deviation of .017 while the mean success score for the same subjects was 1.29 and the standard deviation was .480. The correlation coefficient obtained was +.409 which was significant beyond the .01 level of confidence. Figure 2 illustrates the relationship between the reaction times and success scores of all 102 subjects.

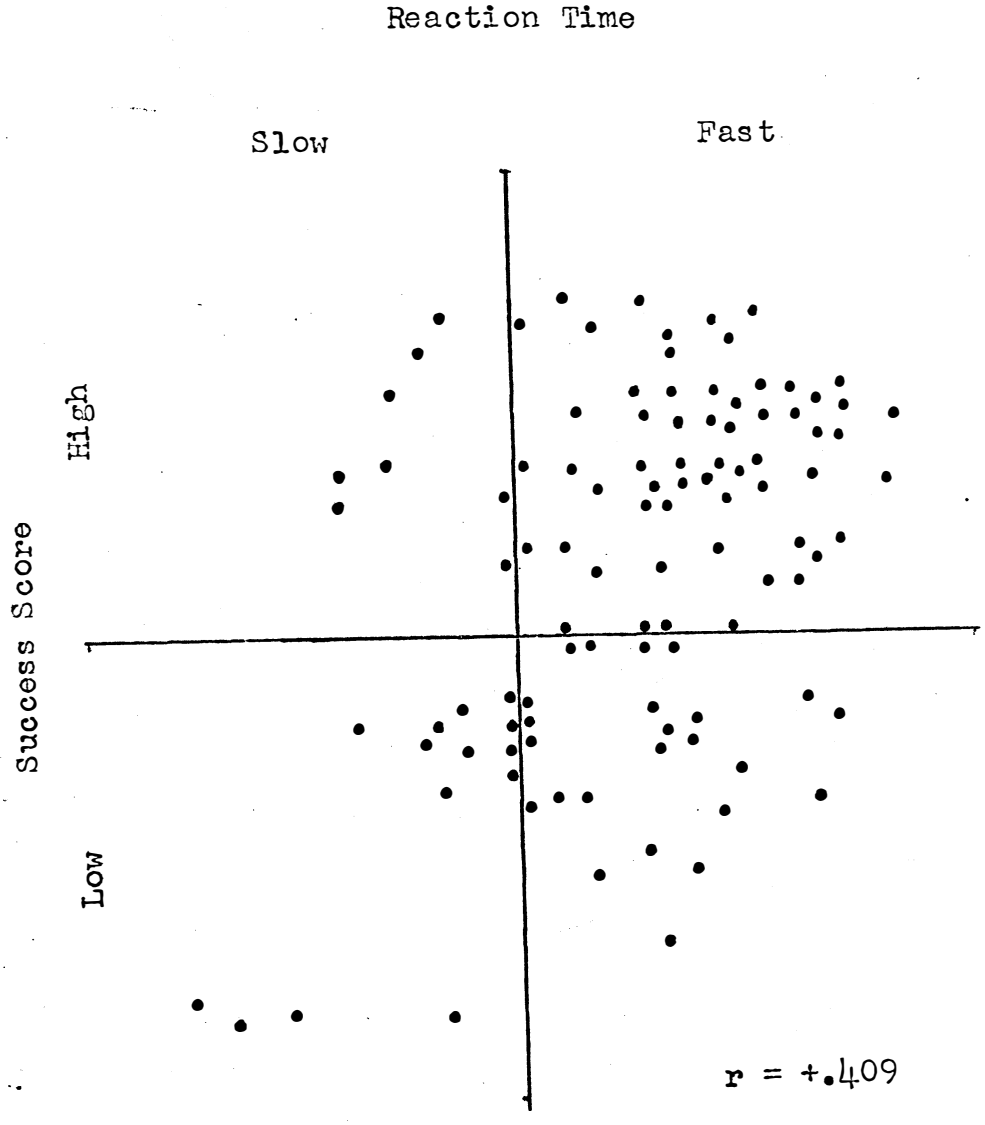

Figure 2--Scattergram showing relationship between mean reaction times and success scores. (N = 102).

Reaction Time Comparison:
District vs. Sectional

The mean of the reaction times of the 64 subjects who participated in the Decatur MacArthur District Tournament was .151 of a second and the standard deviation was .018 while the mean of the reaction times of the 38 subjects who participated in the Champaign Central Sectional Tournament was .141 of a second with a standard deviation of .013. The difference between the means of the two groups was .01 of a second. The Student's t ratio obtained was 2.963 which, according to the table published by Hoel[1], was significant beyond the .01 level of confidence.

Summary and Discussion of Findings

Statistically significant positive correlations between mean reaction times and success scores beyond the .01 level of confidence were found for the three-year experience group and for the composite group, as revealed in Table 1. A positive correlation coefficient significant at the .05 level of confidence was found for the one-year experience group.

The wide variance in the correlation coefficients among the four experience groupings can perhaps be explained, at least in part, by the relatively small numbers in each group. The categorizing of the subjects according to experience was an attempt by the investigator to eliminate the experience variable as a factor which might influence success. While the mean success score did increase consistently with each additional

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[1] Ibid., 320.

TABLE 1

SUMMARY OF FINDINGS CONCERNING RELATIONSHIPS OF REACTION TIMES TO WRESTLING SUCCESS SCORES

Group	N	Mean of R.T.'s	Mean of Success Scores	r
1 yr. exp.	15	.15	.78	+.549*
2 yr. exp.	25	.14	1.16	+.052
3 yr. exp.	29	.14	1.39	+.747**
4 yr. exp.	33	.14	1.52	+.181
Composite	102	.14	1.29	+.409**

*Significant at the .05 level of confidence

**Significant beyond the .01 level of confidence

year of experience, indicating that experience may be an important variable, apparently with the small number of subjects in each experience group, a comparatively few individual subjects showing extreme positive or negative correlations between reaction time and success were able to strongly influence the correlation coefficients for their groups. For example, as can be seen in Appendix C, some wrestlers who had perfect success scores (undefeated and untied) also had very fast mean reaction times while other wrestlers with perfect success scores had very slow mean reaction times. It is for this reason that the writer considers the composite correlation, which employed all 102 subjects, although it disregarded the experience variable, to be the most valuable of the correlations obtained.

The correlation coefficient of +.409 for the composite group was significant beyond the .01 level of confidence, although it is not an extremely high correlation. However, it takes on even more significance when it is remembered that the experience variable was disregarded. The writer believes that the presence of the experience variable, as was the case in the composite correlation study, would tend to lower the coefficient of correlation between reaction time and success.

The highly significant t ratio obtained in the comparison of the reaction times of the District participants with the reaction times of the Sectional participants indicates that the more successful of the two groups, the Sectional participants, had a significantly faster mean reaction time than the less successful group.

Finally, the fact that the mean reaction time for wrestlers with only one year of experience was slower than the means of the more experienced wrestlers may lend support to the studies which have found that physical training lowers reaction time.

It must be remembered that this study merely attempted to measure the tendencies of the subjects as a group or as groups. The presence of numerous individual cases that showed variation from the group tendency indicates that it is impossible to make any rash conclusions or generalizations concerning the importance or lack of importance of reaction time as a factor related to wrestling success.

CHAPTER V

SUMMARY

The present investigation was undertaken for the purpose of trying to determine the relationship of finger reaction time to success in high school wrestling. One hundred-two high school wrestlers from the State of Illinois, 68 from the Decatur MacArthur District Tournament and 34 from the Champaign Sectional Tournament, were tested for finger reaction time in response to a visual (light) stimulus and their won-lost records and years of wrestling experience were recorded. A mean reaction time and success score based on won-lost record was computed for each subject and this data was processed by an IBM # 1620 computer. The subjects were grouped according to the number of years of experience they possessed which ranged from one year through four years. Correlations were then obtained for each of the four groups and for the composite of all four groups. Very low positive correlations were obtained for the two and four year experience groups while significant positive correlations were obtained for the one year and three year experience groups and for the composite group.

As an additional phase of the study, the mean reaction time of the subjects who were participants in the District Tournament was compared with the mean reaction time of the

subjects who participated in the Sectional Tournament and who were considered more successful. A significant t ratio indicated that the more successful group (Sectional participants) demonstrated faster reaction time.

Conclusion

As a result of the findings of this study, the following conclusion appears warranted: Fast finger reactions are significantly related to success in high school wrestling; however, reaction time must be recognized as only one of many factors related to success in wrestling.

Recommendations for Further Study

The experiences of this investigation have influenced the writer to make the following recommendations:

(1) A similar study should be conducted employing more subjects in each experience group and measuring reaction times of other parts of the body as well as finger reaction time.

(2) A study should be undertaken in which a series of individual wrestling matches are investigated and the reaction times of the winner and loser of each match are compared.

APPENDIX

APPENDIX A

Data Sheet

Name	School	Yrs. Exp.	M-L Record	Reaction Time Trials							Mean R.T.

APPENDIX B

SAMPLE LETTER

Herbert Spyke
1002 Tenth St.
Charleston, Illinois

Mr. _____
Wrestling Coach
_____ High School
_____, Illinois

Dear Mr. _____:

Thank you for allowing me to use your wrestlers for my study on the relationship between reaction time and success in high school wrestling which was conducted prior to the Sectional Tournament at Champaign Central High School.

In order for the results of the reaction time tests to be of value to the study, however, I must have the correct won-lost record of each boy tested for this past season. I am interested in all varsity matches, both dual and tournament, prior to the District Tournament only.

I would appreciate it very much if you would fill in the records for each boy in the space provided on the bottom portion of this page and send it to me in the enclosed envelope as soon as possible. None of the boys' names will be mentioned in the study. If you are interested in the results of the study, please indicate so and I will send them to you as soon as they are available.

Thank you once again for your help.

Sincerely yours,

Herbert Spyke

Herbert Spyke

APPENDIX C

RAW DATA

One-year Experience Group

Subject	W-L-T	Success Score	Mean R.T.
1	14- 4-3	1.480	.147
2	3- 2	1.200	.138
3	13- 6	1.368	.131
4	2- 3	0.800	.173
5	4- 6	0.800	.168
6	2- 3-1	0.833	.158
7	6-10-1	0.764	.153
8	5- 8-1	0.786	.123
9	1-13	0.142	.167
10	3-15	0.333	.140
11	1-14	0.133	.185
12	4- 7-1	0.750	.132
13	11- 4	1.466	.160
14	8-10	0.888	.142
15	0- 9	0.000	.197

Two-year Experience Group

16	8-13	0.762	.158
17	6-15	0.571	.145
18	12- 2-1	1.667	.135
19	16-11	1.185	.140
20	18- 8-1	1.370	.163
21	12- 7	1.263	.125
22	20- 5	1.600	.152
23	10- 3	1.538	.140
24	6- 3-1	1.300	.155
25	3- 4-1	0.875	.170
26	4-16	0.400	.143
27	7-13	0.700	.173
28	4- 8	0.667	.130
29	5- 5-1	1.000	.183
30	9-10	0.947	.127
31	11- 3-1	1.533	.140
32	10- 4	1.429	.178
33	7- 2	1.556	.178

Subject	W-L-T	Success Score	Mean R.T.
34	4- 2-3	1.222	.142
35	16- 4	1.600	.145
36	11- 2-1	1.643	.142
37	8- 6-1	1.133	.150
38	8- 3	1.454	.115
39	4- 5	0.889	.122
40	4- 5	0.889	.161

Three-year Experience Group

41	6- 7	0.923	.147
42	14- 4-1	1.526	.128
43	8-10	0.889	.170
44	15- 6	1.428	.158
45	11- 3	1.571	.135
46	19- 3	1.407	.150
47	14-12	1.077	.143
48	19- 2	1.810	.140
49	22- 3	1.760	.125
50	14- 6	1.400	.128
51	22- 3	1.760	.131
52	17- 3	1.700	.137
53	15- 6	1.429	.143
54	21- 2	1.826	.128
55	9- 0	2.000	.140
56	15- 5	1.500	.133
57	7-10	0.842	.163
58	1-14	0.133	.201
59	20- 0	2.000	.135
60	12- 4-1	1.471	.147
61	13- 5-1	1.421	.125
62	8- 7	1.067	.155
63	10- 6-1	1.235	.125
64	7- 5-1	1.154	.145
65	5- 7	0.833	.138
66	19- 0	2.000	.140
67	10- 3	1.538	.133
68	14-12	1.077	.146
69	19- 2	1.810	.142

Subject	W-L-T	Success Score	Mean R.T.
70	23- 6	1.586	.130
71	16- 1-2	1.789	.126
72	13-13	1.000	.147
73	10-16	0.556	.155
74	20- 2	1.818	.126
75	13 -1	1.857	.148
76	18- 0	2.000	.173
77	20- 4	1.667	.123
78	16- 2	1.778	.113
79	9- 3-1	1.462	.175
80	9-12	0.857	.143
81	22- 2	1.833	.133
82	19- 4	1.652	.178
83	22- 0	2.000	.168
84	22- 0	2.000	.152
85	15- 3	1.667	.150
86	14- 4	1.556	.140
87	6- 0	2.000	.133
88	9- 0	2.000	.162
89	7- 2	1.556	.156
90	3- 3-1	1.000	.140
91	12- 4-1	1.470	.131
92	12- 5	1.412	.133
93	16- 2-1	1.737	.143
94	9- 5-1	1.266	.160
95	5- 7	0.833	.158
96	4- 4	1.000	.157
97	6- 4-1	1.182	.150
98	4- 7	0.727	.160
99	20- 1-2	1.826	.137
100	16- 2	1.778	.133
101	20- 6	1.538	.133
102	9- 1	1.900	.138

BIBLIOGRAPHY

LITERATURE CITED

BOOKS

Arkin, Herbert, and Colton, Raymond R. Tables for Statisticians. New York: Barnes and Noble, 1950.

Hoel, Paul G. Introduction to Mathematical Statistics. New York: John Wiley and Sons, Inc., 1954.

Rasch, Philip J., and Kroll, Walter. What Research Tells the Coach About Wrestling. Washington, D.C.: American Association for Health, Physical Education and Recreation, 1964.

PERIODICALS

Keller, Louis F. "The Relation of Quickness of Movement to Success in Athletics," Research Quarterly, March, 1942, pp. 146-55.

Knapp, Barbara. "Simple Reaction Times of Selected Topclass Sportsmen and Research Students," Research Quarterly, October, 1961, pp. 409-10.

Kroll, Walter. "Selected Factors Associated with Wrestling Success," Research Quarterly, March, 1958, pp. 396-406.

Leighton, Jack R. "Flexibility Characteristics of Three Specialized Skill Groups of Champion Athletes," Archives of Physical Medicine, 1957, pp. 580-83.

Lotter, William S. "Influence of Fatiguing Warm-up Exercises on Speed of Movement and Reaction Latency," Research Quarterly, May, 1960, pp. 147-55.

Meister, W. and Kowalzig, G. "Konstitutions - und Kreislaufuntersuchungen an Berufsringein," Biology Abstracts, 1940, p. 438.

Mumby, H. Hugh. "Kinesthetic Acuity and Balance as Related to Wrestling Ability," Research Quarterly, March, 1953, pp. 327-41.

Nash, E. L.; Phelan, J. G.; Deman, G.; and Bittner, T. L. "Effects of Manifest and Induced Anxiety and Experimenter Variability on Simple Reaction Time," Perceptual and Motor Skills, April, 1966, pp. 483-87.

Phillips, William H. "Influence of Fatiguing Warm-up Exercises on Speed of Movement and Reaction Latency," Research Quarterly, October, 1963, pp. 370-78.

Rasch, Philip J., and Brant, John W. A. "Measurements of Pulmonary Function in United States Olympic Freestyle Wrestlers," Research Quarterly, March, 1957, pp. 279-87.

Rasch, Philip J.; Pierson, William P.; O'Connell, Eugene R.; and Hunt, M. B. "Effect of Training for Amateur Wrestling on Total Proportional Strength Scores," Research Quarterly, March, 1961, pp. 201-7.

Rasch, Philip J.; Pierson, William P.; O'Connell, Eugene R.; and Hunt, M. B. "Response Time of Amateur Wrestlers," Research Quarterly, October, 1961, pp. 416-18.

Sigerseth, Peter O., and York, Norman N. "Comparison of Certain Reaction Times of Basketball Players and Non-athletes," The Physical Educator, March, 1954, pp. 51-3.

Tweit, A. H.; Gollnick, P. D.; and Hearn, G. R. "Effect of a Training Program on Total Body Reaction Time of Individuals of Low Fitness," Research Quarterly, December, 1963, pp. 508-13.

Younger, Lois. "A Comparison of Reaction and Movement Times of Women Athletes and Nonathletes," Research Quarterly, October, 1959, pp. 349-55.

UNPUBLISHED MATERIAL

Bremner, J. Barron. "Measurement of Potential Wrestling Ability." (unpublished Master's thesis, University of Iowa, 1964.

Bush, Russell L. "A Study of the Relationships Between Anthropometric Measurements and Wrestling Maneuvers." (unpublished Master's thesis, Purdue University, 1950.

Bryan, Howard M. "Effects of Weight Reduction on Strength and on Muscular Endurance." (unpublished Master's thesis, State University of Iowa, 1953.

Considine, William J. "Reflex and Reaction Times Within and Between Athletes and Nonathletes." (unpublished Master's thesis, Illinois State University, 1966.

Cutlip, John L. "The Effect of Grip Strength in Relation to Success in High School Wrestling." (unpublished Master's thesis, Eastern Illinois University, 1967.

Harsch, Larry A. "A Comparative Study of the Reaction Times and Response Times of Negro and White Athletes." (unpublished Master's thesis, University of Iowa, 1959.

Hoogendoorn, Russell H. "The Effects of Cooling and Various Intensities of Preliminary Exercise on Reaction Time." (unpublished Master's thesis, University of Toledo, 1963.

Lynch, John J. "A Survey Study of the Problems of Weight-reduction in S.S.C.I.F. Wrestling." (unpublished Master's thesis, San Diego State College, 1960.

Meyer, Herbert H. "Anthropometry of Athletes." (unpublished Master's thesis, University of Michigan, 1945.

Smith, Glen R. "Comparison and Relationship Between Reaction Time, Performance Time, and Balance Among Wrestlers and Physical Education Students in College." (unpublished Master's thesis, South Dakota State College, 1960.

Steitz, Edward S. "The Relationship of Reaction Time, Speed, Sargent Jump, Physical Fitness, and Other Variables to Success in Specific Sports." (unpublished Doctoral dissertation, Springfield College, 1963.

Thompson, Carol A. "A Study of Various Reaction Times and Movement Times as Factors of Volleyball Playing Ability." (unpublished Master's thesis, University of Illinois, 1962.

Tomaras, William A. "The Effect of Wrestling Upon Physical Fitness." (unpublished Master's thesis, University of Illinois, 1948.

Wilkinson, James J. "A Study of Reaction Time Measures to a Kinesthetic and Visual Stimulus for Selected Groups of Athletes and Non-athletes." (unpublished Doctoral dissertation, Indiana University, 1958.

VITA

The writer is a graduate of Cleveland Heights High School in Cleveland Heights, Ohio where he won varsity letters in wrestling and track. He received a B. S. in Education with a major in physical education in June of 1967 from Ohio University, Athens, Ohio, where he lettered in wrestling. During the 1967-68 school year, the writer served as a Graduate Assistant in physical education at Eastern Illinois University and received his Master of Science Degree in Education from the same institution in August of 1968.